

Evaluation Report of NIH K-12 Program

Title: Evaluation Report for the NIH4 Module, *The Brain: Our Sense of Self*

Date: 2002

Description:

This report evaluates one component within the NIH K-12 program, the NIH Curriculum Supplements. The NIH Curriculum Supplements are K-12 teacher's guides to two weeks' of lessons that explore the science behind current health topics. The modules are sent free of charge upon request to educators across the United States. Over 50,000 educators have one or more curriculum supplement.

This study specifically examines the results of the field tests conducted during the development of:

The Brain: Our Sense of Self (Grades 7 – 8)

This study was designed to determine the effectiveness of the module as a supplementary addition in the K-12 science curriculum. The field test sites were selected from volunteers who were chosen to maximize inclusion of various races, ethnicities, and geographic regions. The evaluation consisted of a field test with close-to-complete instructional materials. The surveys measured student knowledge using a pre/post test. The teachers also commented on the effectiveness of the lessons and their implementation. These results were used to identify strengths that were highlighted and weaknesses that were corrected in the final draft. The teachers' comments were included in the final draft as "tips from teachers" on specific lessons.

**Evaluation Report
for the
NIH4 Module:
*The Brain: Our Sense of Self***

(BSCS Evaluation Report ER 02-02 May)

Theodore A. Lamb
Research & Evaluation Division
Biological Science Curriculum Studies
5415 Mark Dabbling Blvd.
Colorado Springs, CO 80918-3842
719.531.5550

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For copies please contact: tlamb@bscs.org

TABLE OF CONTENTS

Section I. Executive Summary

Section II. Background Information Concerning the Project

- A. Background and Goals of the Project
- B. The Curriculum Development Process
- C. The Instructional Materials in the Module
- D. Teachers, Students, and Test Sites

Section III. Description of the Evaluation Study

- A. Purposes of the Evaluation
- B. Evaluation Design
- C. Learning Outcomes

Section IV. Results

- A. Surveys Returned
- B. Demographic Results from Surveys Returned
- C. Results of Formative Evaluation
- D. Results of Summative Evaluation

Section V. Discussion of Results

- A. Field Test Demographics
- B. Formative Evaluation Results from Students
- C. Formative Evaluation Results from Teachers
- D. Summative Evaluation Results

Section VI. Conclusions and Recommendations

- A. Conclusions
- B. Recommendations Regarding the Program

References

Appendices

- A. Advisory Board Evaluation Form
- B. Design Conference Evaluation Form
- C. Survey Instruction for the Teachers
- D. Teacher Evaluation of the Materials Survey (TEMS)
- E. Student Knowledge Survey 1 (Pretest)
- F. Student Knowledge Survey 2 (Posttest)
- G. Student Evaluation of the Materials Survey (SEMS)
- H. Perseus Web-based Survey Questionnaire
- I. Comments by Students on the Lessons, Most & Least Valuable Aspects of the Module & Suggestions for Improvements
- J. Comments by Teachers on the Lessons, Most & Least Valuable Aspects of the Module & Suggestions for Improvements

Section I. Executive Summary

BSCS developed a learning module on "The Brain: Our Sense of Self" funded by a grant from the National Institutes of Health. This module was one of three funded by the grant. The evaluation study was designed to determine its effectiveness as supplementary material for middle school instructional materials. The sites were selected from volunteers who were selected to maximize inclusion of different races, ethnicities, geographic regions, and urban-suburban-rural schools.

There were eight schools in the study. The primary site teachers received a field test orientation at BSCS and were paid to be in the study. Secondary site teachers received no orientation or funding but were interested in participating and thus were included. Unfortunately, no evaluation materials were returned by the secondary site teachers. There were 440 students and 8 teachers in the study.

The Formative Evaluation consisted of a field test with close-to-complete instructional materials. Students and teachers completed evaluation questionnaires after using the materials in March, 2002. Tables 65-70 on pages 42-47 are brief "Formative Evaluation Snapshots" of each lesson and are good starting points for developers. The comments on Lessons 1-6, in their totality, are included in Appendix I for the students and Appendix J for the teachers. These appendices also include comments to Most and Least Valuable Aspects of the Module and Suggestions for Changes. The developers are urged to review the comments to sample their diversity, large number, and identify possible areas for change.

The Summative Evaluation consisted of pretest and posttest results from administration of Student Knowledge Surveys. Before using the materials the students took a Knowledge Survey and then the same survey again after completing the materials. The t-test and one-way analysis of variance results suggest statistically significant differences in the increases from pretest to posttest scores when all schools are combined. However, when the schools are analyzed separately, two schools, Llano Jr. HS and Taos Day School, did not show significant differences between pretest and posttest scores. In addition, the teachers responded to questions about the success of the materials in achieving the learning outcomes. These results indicated high agreement with statements on the effectiveness of the module in achieving the established learning outcomes for each lesson. A response category of "Not Sure" which was available to students to indicate total lack of knowledge and blatant uncertainty was also examined and yielded a significant reduction in frequency from pretest to posttest knowledge surveys.

The final sections briefly discuss the results and recommendations for the developers. Recommendations include:

- paying the secondary site teachers a nominal honorarium to return materials in a timely fashion,
- adding more time in future proposals for evaluation data entry, analysis and report writing,
- a local pilot test, and
- tailoring future proposals to include modifications to enable access by persons with disabilities.

Section II. Background Information Concerning the Program

A. Background and Goals of the Program

"The Brain: Our Sense of Self" is one of three modules created with funding from a grant from the National Institutes of Health (NIH). This module is sponsored by the National Institute for Neurological Diseases and Stroke (NINDS) which is part of the NIH.

The final product will be an instructional module composed of four lessons which are designed to be taught in sequence for approximately a week. It is intended to be a replacement for a part of a standard curriculum in middle school. The module is designed to help students achieve the following goals associated with scientific literacy:

- understand a set of basic scientific principles related to the brain and the nervous system;
- experience the process of scientific inquiry and develop an enhanced understanding of the nature and methods of science, and;
- recognize the role of science in society and the relationship between basic science and human health.

B. The Curriculum Development Process.

BSCS uses a curriculum development process that involves an advisory board, an external design team, and an internal writing team. In the Initial Phase, an Advisory Board meeting of experts in the field is convened at the beginning of the development process to identify the key or critical areas of study in the field as well as the key concepts to be conveyed in the materials. Resources are also sought from the Advisory Board. Next, in the Content Review Phase, an external design team of subject matter experts and teachers at the appropriate grade level is brought together for several days of brainstorming and writing. This team, with the input of the Advisory Board, designs the activities and addresses options for structuring the materials. Some writing may be done but that is not the major objective. The Materials Development Phase is next. After input is gained from the Advisory Board and the external Design Team, the BSCS curriculum developers begin the serious task of putting structure and form to the materials and various activities. We then have a Field Test Phase in which the materials are tested with a national sample. The Evaluation Phase consists of analyzing and reporting the results of the Field Test. This is followed by the Final Production Phase in which the materials are modified with the suggestions from the formative and summative evaluation findings and the final curriculum materials are produced.

In order to facilitate the work of the Advisory Board and the external Design Team we developed and administered an Advisory Board Evaluation Form (Appendix A) and a Design Conference Evaluation form (Appendix B). No analysis was performed on the responses generated with these forms. They simply provided input to the project director about how well the meetings went and what modifications to consider for future meetings.

C.. The Instructional Materials in the Module

The final product is suitable for use with any middle school biology program. There are six lessons:

1. Brain Games
2. Making Sense of Our Senses
3. Clear Signals
4. Reflex or Response?
5. Outside Influence, and
6. Replacing Parts and Restoring Function: Is it Possible for the Nervous System?

Each lesson contains readings and activities. There is a website for resources and activities. Additionally, there are Teacher Support Materials to increase the ability of the teachers to use the materials effectively in the classroom.

The materials are designed to incorporate an inquiry-based approach, the 5E model: Engage, Explore, Explain, Elaborate, and Evaluate.

D. Teachers, Students, and Test Sites

Primary Field Test Teachers. Field test teachers were recruited by several methods, including an advertisement placed at the BSCS website, letters of invitation to teachers who had participated in previous BSCS field tests, a notice in the BSCS newsletter, and an ad in The American Biology Teacher published by the National Association of Biology Teachers (NABT). We asked interested teachers to complete a teacher background survey to determine their level of interest and commitment and whether they would be teaching appropriate classes during the test period. The background surveys were reviewed by the project director and staff biologist, selected the participants, and then contacted the teachers to see if they still wanted to participate in the study. One essential criterion was whether or not the teacher had the necessary computer resources available. Additionally, even though by using volunteers we would never have a truly representative sample of schools or school districts, the staff made a concerted attempt to assure inclusion in the selection process by selecting schools that had diverse student populations and represented a variety of economic and geographic contexts.

In January, 2002, the eight selected teachers were brought to BSCS for a 2-day Field Test Orientation. During the orientation the staff introduced the teachers to the key features of the science content and specific activities of the module. The project supported all travel expenses and the participants received an honorarium of \$300.00. After they used the module and BSCS had received the evaluation materials they received an additional honorarium of \$400.00.

Secondary Field Test Teachers. There were more teachers who wanted to be in the field test than we had resources to accommodate. In these cases we sent the materials to the teachers and asked that they use them according to the guidelines in the Teacher Background Materials. These teachers did not receive honoraria and did not participate in a field test orientation, however. We thought this was an additional useful test of the materials which perhaps more accurately portrayed how they would be used by most teachers. Unfortunately, no evaluation materials were returned by secondary site teachers for the Brain module therefore none are included in the analysis.

Students in the Field Test. The students at the primary test sites ranged from 6th to 8th graders in middle school. There were 8 primary test schools in the study from school districts in

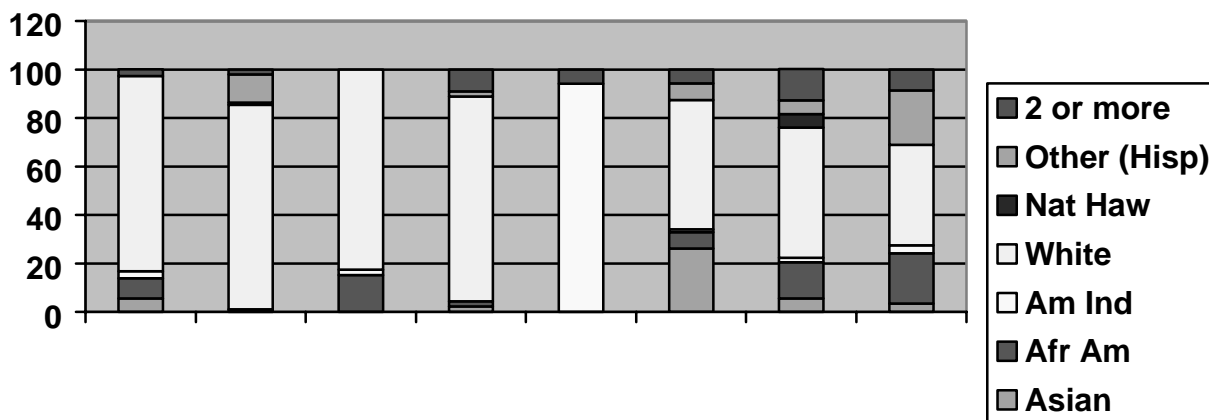
California, Maryland, New Mexico, Indiana, Texas, Washington, Mississippi, and Florida. Figure 1 depicts the dispersed locations of the primary field test sites nationally.

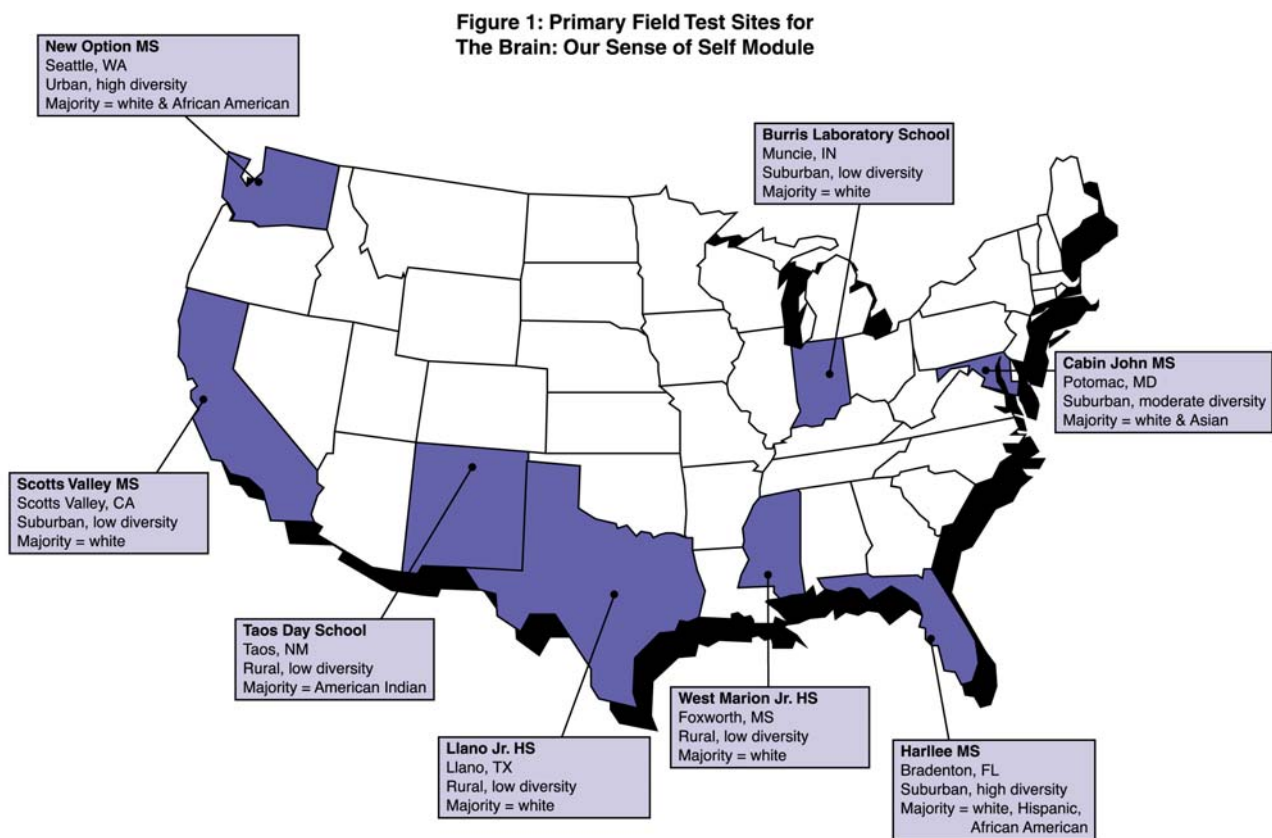
Tables 1 and 2 depict the demographic information for the schools in the field test with approximate breakdowns of race/ethnicity using U.S. Census Bureau categories. These data come from the responses given by the students.

Table 1. Population Characteristics of the Schools in the Field Test

School	% Asian	% Afr Am	% Am Ind	% White	% Nat Hw	% other (Hisp)	% 2 or more
Burriss Lab. School	5.6	8.3	2.8	80.6	0	0	2.8
Llano Jr. HS	0	0	1.0	84.4	1.0	11.5	2.1
West Marion Jr. HS	0	15.2	2.2	82.6	0	0	0
Scotts Valley MS	2.2	2.2	0	84.4	0	2.2	8.9
Taos Day School	0	0	94.1	0	0	0	5.9
Cabin John MS	26.1	6.8	1.1	53.4	0	6.82	5.7
New Option MS	5.6	14.8	1.9	53.7	5.6	5.6	13.0
Harlee MS	3.4	20.7	3.4	41.4	0	22.4	8.6

Table 2. Another depiction of the Population Characteristics of the Field Test Sites





Section III. Description of the Evaluation Study

A. Purposes of the Evaluation

The evaluation had two primary purposes. The first is to gather formative evaluation data about the functionality and usability of the materials. The curriculum developers use formative evaluation findings to revise and improve the final version of the module. The second is to gather preliminary summative information about the module's effectiveness in achieving the learning outcomes.

B. Evaluation Design

Formative Evaluation Design. The formative evaluation includes insights gleaned from the pilot test with local teachers as well as the national field test. There are two primary sources of data for formative data: the Teacher Evaluation of the Materials Survey (TEMS) and the Student Evaluation of the Materials Survey (SEMS). Appendix C contains the instructions we gave to the teachers to facilitate their administration of the surveys. Appendices D and E contain copies of the

TEMS and SEMS respectively. The TEMS contains a series of questions on the following topics for each lesson in the module:

- Text-based Content
- Graphic Content of the Text-based Material
- Format of the Text-based Material
- Organization of the Text-based Material
- Instructional Design of the Text-based Material
- Relevance of the Text-based Material
- the Website.

The teachers to respond to questions about each of these topics on a scale of Strongly Agree to Strongly Disagree and have space to make comments or elaborate their ratings.

At the end of the TEMS we ask questions about the overall difficulty of the module, what the three most valuable aspects and three least valuable aspects were of the module. We also ask the teachers to make specific suggestions to the curriculum developers to improve the module.

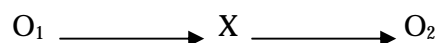
The SEMS has a reduced number of topics and items to which the students respond. Similar to the TEMS, we ask the students to respond to items on the following topics for each lesson in the module:

- Text-based Materials,
- Graphic Content of the Text-base Materials, and
- the Website.

The students also have opportunities to make comments about the module and activities, rate the difficulty of the module, identify the main strengths and weaknesses of the module, and make specific suggestions to the developers.

Summative Evaluation Design. Student Data. The summative evaluation focuses on how effectively the materials helped the students achieve the learning outcomes for each lesson. The present study uses the “One-Group Pretest-Posttest Design” articulated by Campbell and Stanley (1963).

Campbell and Stanley represent the design as:



The initial Observation (O_1) is the pretest, which is followed by administration of the experimental treatment (X) and then the second Observation (O_2) or posttest.

Our initial observation (O_1) is the Student Knowledge Survey 1 (SKS1) a pretest of student knowledge on the brain that teachers gave their students before any exposure to the materials. Teachers then taught the module in their classes until completed. This essentially is the classic experimental treatment (or X in Campbell and Stanley's diagram). The second observation (O_2) is a posttest composed of the same items as the pretest. These items are contained in our Student Knowledge Survey 2. Teachers administered the survey to students at the end of the field test. Appendices E and F contains copies of these surveys. The students answered True or False to statements from which we determined their pretest and posttest scores. In addition, they were

given the option, in both the pretest and posttest of answering “Not Sure” on the items in order to estimate the level of sureness they had with their answers.

This type of summative evaluation is often termed "ipsative", that is, the norm or comparison against which the student is measured is their own prior performance (a pretest). The present performance (a posttest) is compared to the prior performance. In essence, the posttest is the student's "personal best" although it may not be the best in the class. This type of assessment is useful because of the different levels of knowledge or ability at which students enter a class (or use an instructional module). The "difference" or "gain" scores show how much they have increased. A student at the top end on the pretest may not increase as much as the student who scores lower on the pretest merely because there is less room to improve.

Summative Evaluation. Teacher Data. The summative evaluation also contains a second source of data. The teachers use the TEMS to make judgments on how effectively the materials achieved each lessons learning outcomes. Achieving these learning outcomes is the ultimate goal of each lesson. Their answers provide an additional source of summative evaluation data.

Section IV. Results

A. Surveys Returned. The module was tested in eight schools. We received a total of 440 complete student survey sets. A student survey set consists of a SEMs, an SKS1, and an SKS2. There were 14 SEMs, 12 SKS1s, and 10 SKS2s which did not have all of the accompanying survey forms to complete a survey set. This was probably due to student sickness or absence from class for other reasons. We needed all three for complete analysis of the student data. Each teacher completed a Teacher Evaluation of the Materials Survey as well for a total of 8.

B. Demographic Results from Surveys Returned. The student surveys yielded the following results:
The study population was:

Female	52.3 %
Male	47.7 %

Of the valid responses to the question on “Race/Ethnicity” there were:

African American	7.0%
American Indian or Aleut	8.4%
Asian	5.3%
White	65.0%
Nat. Haw or other Pac Isl	.9%
Hispanic	7.7%
Mixed Race	5.7%

Grade Level Distribution	6 =	.2%
	7 =	59.8%
	8 =	39.1%
	9 =	.9%

C. Results of Formative Evaluation

The formative evaluation results come from questionnaires completed by the teachers and the students. Appendices D and G contain copies of the questionnaire for each group. The questionnaires were completed after they had completed using the materials or while they were using the materials. There are demographic questions, fixed-response questions, and open-ended questions on both questionnaires.

The students responded to three sets of questions for each lesson. There were questions on the:

- Text-based Materials,
- Graphic Content of the Text-based Materials, and the
- Website.

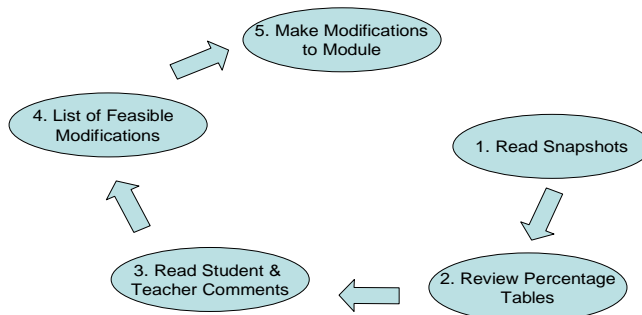
The students indicated their level of agreement or disagreement from strongly agree to strongly disagree with statements in each section. The Tables in the following section provide the results in terms of the percentage of students who indicated which response. In addition, the items are assigned a value: Strongly Disagree = 1, Disagree = 2, Disagree a Little = 3, Agree a Little = 4, Agree = 5, and Strongly Agree = 6. With these values means and standard deviations were calculated and also are reported.

In addition, the students were able and encouraged to make comments on any question in the survey on all lessons. Those comments, in their totality, for all lessons are included in Appendix I. The students were also asked to estimate the overall level of difficulty of the module, identify the main strengths and weaknesses of the module, and make specific suggestions for the developers to improve the module.

Utilization of Evaluation Results by Curriculum Developers. This report is composed of a great deal of different types of information. The figure below is a suggestion for the developers to consider as they review the evaluation results to assist in making improvements to the module. It is suggested, as depicted in Figure 2, that developers:

1. Review the Formative Evaluation Snapshots in Tables 65-70, going on to
2. Review of the Student and Teacher Percentage Tables in Tables 3-62, then
3. Read the Comments by Students and Teachers in Appendices I and J, and
4. Make a list of possible modifications to the module when factors such as feasibility, time, and cost are weighed, and finally
5. Make the modifications to the module within the time constraints of the project.

Figure 2. Utilization of Evaluation Results



Lesson 1 Formative Evaluation from Students. The results for Lesson 1 are presented in three tables: one for the Text-Based Materials items, one for the Graphics Content items, and one for the Website items.

Table 3. Lesson 1 Text-based Materials Questions Percentage Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The lesson was interesting.	2.6	3.3	2.6	17.4	47.5	26.5	4.83	1.11
2. I could understand the examples and explanations.	1.7	.7	4.6	15.6	51.9	25.5	4.92	.96
3. The lesson made me think about new things and questions.	5.3	8.7	11.1	30.0	27.8	16.9	4.17	1.37
4. I could read the material easily.	.7	1.7	3.1	10.8	40.5	43.2	5.18	.95
5. I understood the scientific information clearly.	1.0	3.6	7.7	19.8	41.8	26.1	4.76	1.09
6. The materials and concepts were related to real life examples.	3.4	5.4	9.2	27.5	34.5	20.0	4.44	1.25
7. The materials and concepts fit nicely with the other materials in this course.	1.5	2.6	7.7	24.8	41.4	22.0	4.68	1.07

Table 4. Lesson 1 Graphic Content of the Text-based Materials Questions Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The graphic content helped me understand the material covered.	2.7	4.2	4.9	26.2	46.7	15.3	4.56	1.11
2. The illustrations promoted discussion	2.5	9.2	12.0	26.2	31.9	18.2	4.30	1.29
3. The illustrations promoted thinking and questioning.	3.0	7.7	6.9	22.6	35.7	24.1	4.53	1.30
4. The illustrations motivated me to read the text.	5.9	11.3	10.5	27.4	29.9	15.0	4.09	1.41

Table 5. Lesson 1 Website Questions Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The website was clearly connected to the lesson.	1.6	1.6	6.1	15.9	40.2	34.6	4.95	1.07
2. I was able to navigate easily in the website without confusion.	3.7	4.1	6.2	16.5	33.7	35.8	4.80	1.30
3. The website made the lesson more understandable.	5.3	4.5	8.1	22.3	31.6	28.3	4.55	1.37
4. The website made the lesson more interesting.	3.6	3.6	5.7	13.4	33.2	40.5	4.90	1.29

Lesson 1 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. The lesson 1 difficulty mean = 3.55, std. dev. = 2.04.

Lesson 2 Formative Evaluation from Students. The results for Lesson 2 are presented in three tables: one for the Text-Based Materials items, one for the Graphics Content items, and one for the Website items.

Table 6. Lesson 2 Text-based Materials Questions Percentage Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The lesson was interesting.	1.7	3.5	5.9	17.5	38.7	32.8	4.62	1.19
2. I could understand the examples and explanations.	1.0	1.9	5.7	16.9	47.4	27.1	4.71	.98
3. The lesson made me think about new things and questions.	4.5	11.1	9.7	23.4	29.1	22.2	4.19	1.23
4. I could read the material easily.	.7	.2	2.7	10.4	41.4	44.6	4.74	1.02
5. I understood the scientific information clearly.	.5	3.4	4.3	18.6	40.2	32.8	4.56	1.02
6. The materials and concepts were related to real life examples.	1.7	6.7	8.6	24.0	30.2	28.8	4.39	1.14
7. The materials and concepts fit nicely with the other materials in this course.	1.7	1.9	8.0	22.3	43.6	22.5	4.49	1.01

Table 7. Lesson 2 Graphic Content of the Text-based Materials Questions Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The graphic content helped me understand the material covered.	4.0	5.9	6.9	30.2	39.1	13.9	4.65	1.05
2. The illustrations promoted discussion	4.9	9.8	9.3	25.1	33.9	16.9	4.53	1.12
3. The illustrations promoted thinking and questioning.	4.7	13.1	8.4	21.5	31.9	20.4	4.52	1.05
4. The illustrations motivated me to read the text.	7.1	9.8	17.9	25.5	31.5	8.2	3.97	1.32

Lesson 2 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. The lesson 2 difficulty mean = 3.60, std. dev. = 2.25.

Lesson 3 Formative Evaluation from Students. The results for Lesson 3 are presented in three tables: one for the Text-Based Materials items, one for the Graphics Content items, and one for the Website items.

Table 8. Lesson 3 Text-based Materials Questions Percentage Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The lesson was interesting.	2.7	4.5	4.7	23.0	41.7	23.5	4.67	1.18
2. I could understand the examples and explanations.	.5	1.0	4.2	14.1	50.5	29.7	5.02	.88
3. The lesson made me think about new things and questions.	4.7	9.5	16.5	26.7	26.7	16.0	4.09	1.37
4. I could read the material easily.	.5	1.5	1.8	11.2	45.2	39.8	5.18	.88
5. I understood the scientific information clearly.	1.8	1.3	4.3	18.9	45.7	28.0	4.90	1.02
6. The materials and concepts were related to real life examples.	2.5	4.8	8.0	20.6	38.1	26.1	4.65	1.22
7. The materials and concepts fit nicely with the other materials in this course.	1.8	1.8	4.8	26.1	47.6	18.0	4.70	.99

Table 9. Lesson 3 Graphic Content of the Text-based Materials Questions Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The graphic content helped me understand the material covered.	1.6	4.3	7.5	23.9	37.0	25.7	4.68	1.16
2. The illustrations promoted discussion	3.0	5.4	8.1	24.5	38.7	20.4	4.52	1.26
3. The illustrations promoted thinking and questioning.	4.0	7.7	9.3	23.5	35.5	20.0	4.39	1.33
4. The illustrations motivated me to read the text.	4.3	9.5	13.6	28.0	30.3	14.2	4.13	1.33

Lesson 3 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. The lesson 3 difficulty mean = 2.77, std. dev. = 2.14.

Lesson 4 Formative Evaluation from Students. The results for Lesson 4 are presented in three tables: one for the Text-Based Materials items, one for the Graphics Content items, and one for the Website items.

Table 10. Lesson 4 Text-based Materials Questions Percentage Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The lesson was interesting.	2.2	5.7	7.4	16.7	37.9	30.0	4.73	1.25
2. I could understand the examples and explanations.	1.7	3.5	9.2	24.1	42.4	19.1	4.59	1.11
3. The lesson made me think about new things and questions.	4.4	8.9	11.4	26.4	33.6	15.3	4.22	1.33
4. I could read the material easily.	1.8	4.3	7.8	20.5	40.8	25.0	4.70	1.16
5. I understood the scientific information clearly.	2.2	5.2	10.4	20.1	39.8	22.1	4.56	1.22
6. The materials and concepts were related to real life examples.	2.0	2.3	5.0	15.8	39.2	35.7	4.95	1.11
7. The materials and concepts fit nicely with the other materials in this course.	1.5	3.5	6.3	18.0	45.6	24.8	4.78	1.11

Table 11. Lesson 4 Graphic Content of the Text-based Materials Questions Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The graphic content helped me understand the material covered.	1.5	3.6	4.1	21.0	39.5	30.3	4.84	1.11
2. The illustrations promoted discussion	3.8	7.6	9.2	22.6	31.0	25.7	4.47	1.37
3. The illustrations promoted thinking and questioning.	4.4	6.9	5.9	20.8	37.4	24.6	4.54	1.34
4. The illustrations motivated me to read the text.	6.5	6.5	10.1	25.6	30.8	20.5	4.29	1.41

Table 12. Lesson 4 Website Questions Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The website was clearly connected to the lesson.	.5	1.3	3.2	6.9	38.3	49.9	5.31	.90
2. I was able to navigate easily in the website without confusion.	1.1	5.3	8.2	18.6	34.6	32.2	4.77	1.20
3. The website made the lesson more understandable.	1.9	3.2	4.3	18.6	38.5	33.4	4.89	1.13
4. The website made the lesson more interesting.	1.6	2.7	2.9	14.4	26.1	52.3	5.18	1.12

Lesson 4 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. The lesson 4 difficulty mean = 4.55, std. dev. = 2.58.

Lesson 5 Formative Evaluation from Students. The results for Lesson 5 are presented in three tables: one for the Text-Based Materials items, one for the Graphics Content items, and one for the Website items.

Table 13. Lesson 5 Text-based Materials Questions Percentage Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The lesson was interesting.	2.7	4.4	6.4	18.6	39.0	28.9	4.74	1.22
2. I could understand the examples and explanations.	1.7	2.0	3.7	16.5	48.2	28.0	4.91	1.02
3. The lesson made me think about new things and questions.	3.2	6.9	9.4	24.7	30.9	24.9	4.48	1.32
4. I could read the material easily.	1.0	2.0	3.7	14.3	47.0	32.0	5.00	.97
5. I understood the scientific information clearly.	1.0	1.5	4.7	17.5	45.3	30.0	4.95	.98
6. The materials and concepts were related to real life examples.	2.5	3.5	5.8	17.8	38.6	31.8	4.82	1.19
7. The materials and concepts fit nicely with the other materials in this course.	2.3	3.5	5.1	19.2	43.8	26.1	4.77	1.14

Table 14. Lesson 5 Graphic Content of the Text-based Materials Questions Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The graphic content helped me understand the material covered.	1.8	3.3	6.1	20.7	35.6	32.6	4.83	1.15
2. The illustrations promoted discussion	2.0	6.6	6.6	19.5	41.8	23.5	4.63	1.22
3. The illustrations promoted thinking and questioning.	2.8	4.5	8.0	20.1	42.0	22.6	4.62	1.21
4. The illustrations motivated me to read the text.	5.3	7.3	7.1	23.9	34.8	21.7	4.41	1.38

Lesson 5 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. The lesson 5 difficulty mean = 3.39, std. dev. = 2.30.

Lesson 6 Formative Evaluation from Students. The results for Lesson 6 are presented in three tables: one for the Text-Based Materials items, one for the Graphics Content items, and one for the Website items.

Table 15. Lesson 6 Text-based Materials Questions Percentage Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The lesson was interesting.	2.8	5.5	6.2	20.1	41.7	23.7	4.64	1.23
2. I could understand the examples and explanations.	1.2	2.1	4.5	15.9	50.9	25.4	4.89	.98
3. The lesson made me think about new things and questions.	2.4	6.7	9.0	26.4	38.6	16.9	4.43	1.21
4. I could read the material easily.	.5	2.4	4.3	13.2	47.0	32.6	5.02	.96
5. I understood the scientific information clearly.	1.2	1.4	5.2	17.9	47.9	26.4	4.89	.98
6. The materials and concepts were related to real life examples.	1.4	2.4	3.8	14.2	41.6	36.5	5.02	1.05
7. The materials and concepts fit nicely with the other materials in this course.	1.7	2.9	5.8	19.1	45.8	24.7	4.78	1.07

Table 16. Lesson 6 Graphic Content of the Text-based Materials Questions Results for Students.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The graphic content helped me understand the material covered.	3.5	4.8	6.8	20.3	37.6	27.1	4.65	1.27
2. The illustrations promoted discussion	4.3	6.8	10.6	24.1	36.9	17.3	4.35	1.31
3. The illustrations promoted thinking and questioning.	4.7	5.2	11.0	22.4	38.2	18.5	4.39	1.31
4. The illustrations motivated me to read the text.	6.3	7.6	10.3	23.4	33.2	19.1	4.27	1.41

Lesson 6 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. The lesson 6 difficulty mean = 3.70, std. dev. = 2.32.

Additional Analyses.

C. Students Interest in Science. The students were also asked three questions to determine their interest in science. The results for these three questions are summarized in Table 17.

Table 17. Students' Level of interest in Science Questions Results.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. I am very interested in science, in general.	4.6	4.8	9.6	34.2	34.9	11.9	4.25	1.22
2. I am very interested in Biology.	4.8	8.9	19.2	34.3	20.8	11.9	3.93	1.29
3. I am good at science, in general.	3.7	4.3	12.6	33.8	35.8	9.8	4.23	1.15

Overall Module Results.

Module Difficulty. The students were also asked about the overall difficulty of the module. They rated the difficulty on a scale of 1 to 9 in which 1=too easy, 5=just right, and 9=too hard. The average level of difficulty was 4.77, std. dev. = 1.49.

Most and Least Valuable Aspects of the Module and Suggestions for Improvements. The students were asked to respond to an open-ended question on the most and least valuable aspects of the module and suggestions for improvements in the module. These comments, in their totality, are included in Appendix I.

Lesson Comparisons from Students. The lessons each have scores from the students on several dimensions. Table 18 depicts the mean scores and standard deviation for each lesson when compared to the other lessons.

Table 18. Comparison of Lessons by Evaluation Dimension: Student Results

Evaluation Dimension	Lesson 1 Brain Games Mean & Std. dev.	Lesson 2 Making Sense of Our Senses Mean & Std. dev.	Lesson 3 Clear Signals Mean & Std. dev.	Lesson 4 Reflex or Response? Mean & Std. dev.	Lesson 5 Outside Influence Mean & Std. dev.	Lesson 6 Replacing Parts Mean & Std. dev.
Text-based Content	4.72 .76	4.81 .76	4.74 .76	4.65 .87	4.83 .87	4.82 .81
Graphic Content	4.33 1.03	4.17 1.16	4.42 1.03	4.54 1.08	4.62 1.05	4.43 1.12
Website	4.33 1.03	N/A	N/A	5.03 .86	N/A	N/A
Level of Difficulty (Scale of 1-9)	3.55 2.04	3.60 2.25	2.77 2.14	4.55 2.58	3.39 2.30	3.70 2.32

Formative Evaluation Results from Teachers. The teachers completed a "Teacher Evaluation of the Materials Survey" or TEMS. This survey had a page of general information about their classes and how they used the materials. The TEMS had more items for the teachers to respond to such as

format, organization, and instructional design of the materials as well as the overall questions on the module.

Formative Evaluation Results for Each Lesson from the Teachers. The results for each lesson are presented in eight tables: Text-Based Materials, Graphics Content items, Format of the Text-Based Materials, Organization of the Text-based Materials, Instructional Design of the Text-based Materials, Relevance of the Text-based Materials, Website, and Effectiveness in Achieving Learning Outcomes. In addition, there is a Table of Results of reviews of the comments made by teachers on each lesson. This is followed by a Table comparing the teacher results for each lesson.

Table 19. Lesson 1 Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The content was accurate and current.	0	0	0	0	12.5	87.5	5.88	.35
2. The reading level was appropriate for my students.	0	0	0	0	37.5	62.5	5.63	.52
3. The vocabulary was listed separately in a useful glossary.	0	100	0	0	0	0	2.0	0
4. The material stimulated new thinking and inquiry.	0	0	0	0	25.0	75.0	5.75	.46
5. The examples and explanations were at the appropriate level.	0	0	0	0	12.5	87.5	5.86	.35
6. The material was engaging (i.e. the students got more interested in the science content).	0	0	0	0	12.5	87.5	5.86	.35
7. The students could understand the scientific information clearly.	0	0	0	0	25.0	75.0	5.75	.46

Table 20. Lesson 1 Graphic Content of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Illustrations, charts, maps, or graphs were clear and meaningful.	0	0	0	0	62.5	37.5	5.38	.52
2. Graphic content helped students understand the material covered.	0	12.5	0	0	25.0	62.5	5.25	1.39
3. Illustrations promoted student thinking, discussion, problem solving, and inquiry.	0	0	0	0	37.5	62.5	5.63	.52
4. Illustrations motivated students to read the text.	0	0	0	0	75.0	25.0	5.25	.50
5. The material was engaging (i.e. it got them to do interesting things	0	0	0	0	25.0	75.0	5.75	.46

Table 21. Lesson 1 Format of the Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Lessons contained an appropriate amount of material.	0	0	0	0	50.0	50.0	5.50	.53
2. The size and format of print was appropriate.	0	0	0	0	37.5	62.5	5.63	.52

Table 22. Lesson 1 Organization of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The organization of the lessons (chronological, thematic) facilitated the development of specific concepts or skills identified in the lesson objectives.	0	0	0	0	25.0	75.0	5.75	.46
2. Main concepts were presented logically.	0	0	0	0	25.0	75.0	5.75	.46
3. The information was presented at an age-appropriate pace.	0	0	0	0	25.0	75.0	5.75	.46

Table 23. Lesson 1 Instructional Design of Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The amount of prerequisite knowledge required to understand the material was acceptable.	0	0	0	0	50.0	50.0	5.50	.53
2. The learning objectives were stated clearly.	0	0	0	0	37.5	62.5	5.63	.52
3. The instruction followed an inquiry-based approach.	0	0	0	0	12.5	87.5	5.88	.35

Table 24. Lesson 1 Relevance of Text-based Materials Questions Results from Teachers.

	Percent		Percent	Percent		Percent		
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Question	Strongly Disagree	Percent Disagree	Disagree a Little	Agree a Little	Percent Agree	Strongly Agree	Mean	Std. Dev.
1. Materials and concepts were related to real life examples.	0	0	0	0	25.0	75.0	5.753	.46
2. Module materials and concepts fit nicely with my existing instructional materials.	0	0	0	0	28.6	71.4	5.71	.49

Table 25. Lesson 1 Website Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The relationship of the website to the lesson was clear.	0	0	0	0	14.3	85.7	5.86	.38
2. The students were able to navigate easily in the website without confusion.	0	0	0	14.3	42.9	42.9	5.29	.76
3. The website added to the lesson.	0	0	0	0	0	100	6.00	0
4. The website material was engaging (i.e. it got us to do interesting things).	0	0	0	14.3	0	85.7	5.71	.76

Table 26. Lesson 1 Effectiveness in Achieving Learning Outcomes Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Students should recognize that the brain is capable of performing many diverse functions.	0	12.5	0	0	25.0	62.5	5.25	1.39
2. Students should be able to explain how various brain functions contribute to human learning.	0	0	0	0	50.0	50.0	5.50	.53

Lesson 1 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. As judged by teachers, the lesson 1 difficulty mean = 3.00, std. dev. = 1.00.

Table 27. Lesson 2 Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The content was accurate and current.	0	0	0	0	60.0	40.0	5.50	.53
2. The reading level was appropriate for my students.	0	0	0	0	60.0	40.0	5.43	.53
3. The vocabulary was listed separately in a useful glossary.	0	0	0	0	50	50	4.00	2.83
4. The material stimulated new thinking and inquiry.	0	0	0	6.7	53.3	40.0	5.38	.74
5. The examples and explanations were at the appropriate level.	0	0	0	6.7	60.0	33.3	5.63	.52
6. The material was engaging (i.e. the students got more interested in the science content).	0	0	0	6.7	66.7	26.7	5.00	1.41
7. The students could understand the scientific information clearly.	0	0	0	13.3	73.3	13.3	5.50	.53

Table 28. Lesson 2 Graphic Content of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Illustrations, charts, maps, or graphs were clear and meaningful.	0	0	6.7	0	53.8	38.5	5.25	.50
2. Graphic content helped students understand the material covered.	0	0	0	8.3	41.7	50.0	5.33	.57
3. Illustrations promoted student thinking, discussion, problem solving, and inquiry.	0	0	0	9.1	36.4	54.5	5.50	.58
4. Illustrations motivated students to read the text.	0	0	0	16.7	66.7	16.7	5.50	.71
5. The material was engaging (i.e. it got them to do interesting things	0	0	0	6.7	33.3	60.0	5.50	.84

Table 29. Lesson 2 Format of the Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Lessons contained an appropriate amount of material.	0	0	0	13.3	53.3	33.3	5.14	1.21
2. The size and format of print was appropriate.	0	0	0	0	46.2	53.8	5.75	.46

Table 30. Lesson 2 Organization of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The organization of the lessons (chronological, thematic) facilitated the development of specific concepts or skills identified in the lesson objectives.	0	0	0	6.7	40	53.3	5.75	.46
2. Main concepts were presented logically.	0	0	0	0	60.0	40.0	5.63	.52
3. The information was presented at an age-appropriate pace.	0	0	0	6.7	46.7	46.7	5.13	1.46

Table 31. Lesson 2 Instructional Design of Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The amount of prerequisite knowledge required to understand the material was acceptable.	0	0	0	14.3	57.1	28.6	5.63	.52
2. The learning objectives were stated clearly.	0	0	0	0	53.3	46.7	5.86	.35
3. The instruction followed an inquiry-based approach.	0	0	0	6.7	40	53.3	5.75	.46

Table 32. Lesson 2 Relevance of Text-based Materials Questions Results from Teachers.

	Percent		Percent	Percent		Percent		
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Question	Strongly Disagree	Percent Disagree	Disagree a Little	Agree a Little	Percent Agree	Strongly Agree	Mean	Std. Dev.
1. Materials and concepts were related to real life examples.	0	0	6.7	0	80.0	33.3	5.25	1.39
2. Module materials and concepts fit nicely with my existing instructional materials.	0	0	7.1	0	57.1	35.7	5.86	.38

Table 33. Lesson 2 Effectiveness in Achieving Learning Outcomes Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Students should appreciate that the body gathers multiple types of sensory information.	0	0	0	33.3	46.7	20.0	5.67	.58
2. Students should recognize that the brain is responsible for correctly combining multiple types of sensory information.	0	0	0	20.0	53.3	26.7	5.67	.58
3. Students should understand that combining multiple types of sensory information improves our ability to understand our environment.	0	0	0	20.0	40.0	40.0	5.67	.58

Lesson 2 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. As judged by teachers, the lesson 2 difficulty mean = 4.00, std. dev. = 0.00 (all responses were 4).

Table 34. Lesson 3 Text-based Materials Questions Results from Teachers.

	Percent		Percent	Percent		Percent		
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Question	Strongly Disagree	Percent Disagree	Disagree a Little	Agree a Little	Percent Agree	Strongly Agree	Mean	Std. Dev.
1. The content was accurate and current.	0	0	12.5	0	37.5	50.0	5.25	1.04
2. The reading level was appropriate for my students.	0	0	0	12.5	37.5	50.0	5.38	.74
3. The vocabulary was listed separately in a useful glossary.	0	0	0	0	33.3	66.7	5.67	.58
4. The material stimulated new thinking and inquiry.	0	0	0	0	57.1	42.9	5.43	.53
5. The examples and explanations were at the appropriate level.	0	25.0	0	0	25.0	50.0	4.75	1.75
6. The material was engaging (i.e. the students got more interested in the science content).	0	0	0	0	71.4	28.6	5.29	.63
7. The students could understand the scientific information clearly.	0	0	0	14.3	42.9	42.9	5.29	.76

Table 35. Lesson 3 Graphic Content of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Illustrations, charts, maps, or graphs were clear and meaningful.	0	0	0	12.5	62.5	25.0	5.13	.64
2. Graphic content helped students understand the material covered.	0	16.7	0	0	50.0	33.3	4.83	1.47
3. Illustrations promoted student thinking, discussion, problem solving, and inquiry.	0	0	0	0	50.0	50.0	5.50	.53
4. Illustrations motivated students to read the text.	0	50.0	0	0	0	50.0	4.00	2.83
5. The material was engaging (i.e. it got them to do interesting things	0	12.5	0	0	50.0	37.5	5.00	1.31

Table 36. Lesson 3 Format of the Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Lessons contained								

an appropriate amount of material.	0	0	0	0	37.5	62.5	5.63	.52
2. The size and format of print was appropriate.	0	0	0	0	37.5	62.5	5.63	.52

Table 37. Lesson 3 Organization of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The organization of the lessons (chronological, thematic) facilitated the development of specific concepts or skills identified in the lesson objectives.	0	0	0	0	25.0	75.0	5.75	.46
2. Main concepts were presented logically.	0	0	0	0	25.0	75.0	5.75	.46
3. The information was presented at an age-appropriate pace.	0	12.5	0	0	12.5	75.0	5.38	1.41

Table 38. Lesson 3 Instructional Design of Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The amount of prerequisite knowledge required to understand the material was acceptable.	0	0	0	0	50.0	50.0	5.50	.53
2. The learning objectives were stated clearly.	0	0	0	0	50.0	50.0	5.50	.53
3. The instruction followed an inquiry-based approach.	0	0	0	12.5	37.5	50.0	5.38	.74

Table 39. Lesson 3 Relevance of Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Materials and concepts were related to real life examples.	0	12.5	12.5	0	50.0	25.0	4.63	1.41

2. Module materials and concepts fit nicely with my existing instructional materials.	0	0	0	0	28.6	71.4	5.71	.49
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Table 40. Lesson 3 Effectiveness in Achieving Learning Outcomes Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Students should be able to explain that the brain generates responses that the body carries out.	0	0	0	0	66.7	33.3	5.33	.58
2. Students should be able to articulate that the brain must correctly process information before producing a response.	0	0	0	0	66.7	33.3	5.33	.58
3. Students should be able to describe the significance of the brain to information flow.	0	0	0	33.3	0	66.7	5.33	1.15
4. Students should understand that information flows through specialized cells called neurons.	0	0	0	33.3	33.3	33.3	5.00	1.00

Lesson 3 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. As judged by teachers, the lesson 3 difficulty mean = 3.67, std. dev. = .577

Table 41. Lesson 4 Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The content was accurate and current.	0	0	0	0	50.0	50.0	5.50	.54
2. The reading level was appropriate for my students.	0	12.5	0	12.5	37.5	37.5	4.88	1.36
3. The vocabulary was listed separately in a useful glossary.	0	14.3	0	14.3	14.3	57.1	5.00	1.53
4. The material stimulated new thinking and inquiry.	0	0	0	0	25.0	75.0	5.75	.46
5. The examples and explanations were at the appropriate level.	0	0	0	0	25.0	75.0	5.75	.46
6. The material was engaging (i.e. the students got more interested in the science content).	0	12.5	0	0	12.5	75.0	5.38	1.41
7. The students could understand the scientific information clearly.	0	25.0	0	12.5	12.5	50.0	4.63	1.77

Table 42. Lesson 4 Graphic Content of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Illustrations, charts, maps, or graphs were clear and meaningful.	0	0	0	0	57.1	42.9	5.43	.53
2. Graphic content helped students understand the material covered.	0	0	12.5	0	37.5	50.0	5.25	1.04
3. Illustrations promoted student thinking, discussion, problem solving, and inquiry.	0	0	12.5	0	12.5	75.0	5.50	1.07
4. Illustrations motivated students to read the text.	0	12.5	12.5	0	50.0	25.0	4.63	1.41
5. The material was engaging (i.e. it got them to do interesting things	0	0	12.5	0	0	87.5	5.63	1.06

Table 43. Lesson 4 Format of the Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Lessons contained an appropriate amount of material.	12.5	12.5	0	0	25.0	50.0	4.63	1.99
2. The size and format of print was appropriate.	0	0	0	0	37.5	62.5	5.63	.52

Table 44. Lesson 4 Organization of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The organization of the lessons (chronological, thematic) facilitated the development of specific concepts or skills identified in the lesson objectives.	12.5	0	0	0	37.5	50.0	5.00	1.69
2. Main concepts were presented logically.	0	25.0	0	0	25.0	50.0	4.75	1.75
3. The information was presented at an age-appropriate pace.	12.5	0	0	0	37.5	50.0	5.00	1.69

Table 45. Lesson 4 Instructional Design of Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The amount of prerequisite knowledge required to understand the material was acceptable.	12.5	0	0	0	50.0	37.5	4.86	1.64
2. The learning objectives were stated clearly.	0	0	0	0	50.0	50.0	5.50	.53
3. The instruction followed an inquiry-based approach.	0	0	0	0	12.5	87.5	5.88	.35

Table 46. Lesson 4 Relevance of Text-based Materials Questions Results from Teachers.

	Percent		Percent	Percent		Percent		
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Question	Strongly Disagree	Percent Disagree	Disagree a Little	Agree a Little	Percent Agree	Strongly Agree	Mean	Std. Dev.
1. Materials and concepts were related to real life examples.	0	0	0	0	25.0	75.0	5.75	.46
2. Module materials and concepts fit nicely with my existing instructional materials.	0	0	14.3	0	14.3	71.4	5.43	1.13

Table 47. Lesson 4 Effectiveness in Achieving Learning Outcomes Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Students should understand that neurons in the body are connected into circuits.	0	12.5	0	0	0	87.5	5.50	1.41
2. Students should be able to describe the path of information flow through a neural circuit.	0	37.5	0	0	0	62.5	4.50	2.07
3. Students should be able to construct correct circuits for both voluntary and involuntary actions.	0	12.5	0	0	0	87.5	5.50	1.41
4. Students should recognize that reflex circuits involve the spinal cord and not the brain, while all voluntary circuits require neural connections to the brain.	0	0	12.5	0	0	87.5	5.63	1.06
5. Students should be able to explain why we have more control over our voluntary circuits than our involuntary circuits.	0	0	0	0	12.5	87.5	5.86	.35

Table 48. Lesson 4 Website Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The relationship of								

the website to the lesson was clear.	12.5	0	0	0	37.5	50.0	5.00	1.69
2. The students were able to navigate easily in the website without confusion.	0	12.5	0	0	37.5	50.0	5.13	1.36
3. The website added to the lesson.	0	0	0	0	12.5	87.5	5.86	.35
4. The website material was engaging (i.e. it got us to do interesting things).	0	25.0	0	0	0	75.0	5.00	2.00

Lesson 4 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. As judged by teachers, the lesson 4 difficulty mean = 7.67, std. dev. = 1.53.

Table 49. Lesson 5 Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The content was accurate and current.	0	0	0	0	37.5	62.5	5.63	.52
2. The reading level was appropriate for my students.	0	0	0	0	37.5	62.5	5.63	.52
3. The vocabulary was listed separately in a useful glossary.	0	0	0	0	50.0	50.0	5.50	.71
4. The material stimulated new thinking and inquiry.	0	12.5	0	13.3	0	75.0	5.38	1.41
5. The examples and explanations were at the appropriate level.	0	0	0	0	37.5	62.5	5.63	.52
6. The material was engaging (i.e. the students got more interested in the science content).	0	12.5	0	0	12.5	75.0	5.38	1.41
7. The students could understand the scientific information clearly.	0	0	0	0	37.5	62.5	5.63	.52

Table 50. Lesson 5 Graphic Content of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Illustrations, charts, maps, or graphs were clear and meaningful.	0	0	0	0	0	100	6.00	.00
2. Graphic content helped students understand the material covered.	0	0	0	0	0	100	6.00	.00
3. Illustrations promoted student thinking, discussion, problem solving, and inquiry.	0	0	0	0	12.5	87.5	5.88	.35
4. Illustrations motivated students to read the text.	0	0	0	0	42.9	57.1	5.57	.53
5. The material was engaging (i.e. it got them to do interesting things	0	12.5	0	0	12.5	75.0	5.38	1.41

Table 51. Lesson 5 Format of the Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Lessons contained an appropriate amount of material.	0	12.5	0	0	25.0	75.0	5.25	1.39
2. The size and format of print was appropriate.	0	0	0	0	28.6	71.4	5.71	.49

Table 52. Lesson 5 Organization of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The organization of the lessons (chronological, thematic) facilitated the development of specific concepts or skills identified in the lesson objectives.	0	0	12.5	0	25.0	62.5	5.38	1.06
2. Main concepts were presented logically.	0	0	0	0	14.3	85.7	5.86	.38
3. The information was presented at an age-appropriate pace.	0	0	0	0	25.0	75.0	5.75	.46

Table 53. Lesson 5 Instructional Design of Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The amount of prerequisite knowledge required to understand the material was acceptable.	0	0	0	0	50.0	50.0	5.50	.53
2. The learning objectives were stated clearly.	0	0	0	0	25.0	75.0	5.75	.46
3. The instruction followed an inquiry-based approach.	0	0	0	0	12.5	87.5	5.86	.35

Table 54. Lesson 5 Relevance of Text-based Materials Questions Results from Teachers.

	Percent		Percent	Percent		Percent		
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Question	Strongly Disagree	Percent Disagree	Disagree a Little	Agree a Little	Percent Agree	Strongly Agree	Mean	Std. Dev.
1. Materials and concepts were related to real life examples.	0	0	0	0	25.0	75.0	5.75	.46
2. Module materials and concepts fit nicely with my existing instructional materials.	0	0	0	0	16.7	83.3	5.83	.41

Table 55. Lesson 5 Effectiveness in Achieving Learning Outcomes Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Students should be able to explain the relationship between a hypothesis and experimental data.	33.3	0	0	0	33.3	33.3	4.00	2.65
2. Students should be able to describe how the environment can affect both the structure and function of the brain.	0	0	0	0	0	100	6.00	.00
3. Students should understand that the brain changes throughout life.	0	0	0	0	33.3	66.7	5.67	.58

Lesson 5 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. As judged by teachers, the lesson 5 difficulty mean = 5.00, std. dev. = .00 (all responses were 5).

Table 56. Lesson 6 Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The content was accurate and current.	0	0	0	0	42.90	57.1	5.57	.53
2. The reading level was appropriate for my students.	0	0	0	0	42.9	57.1	5.57	.53
3. The vocabulary was listed separately in a useful glossary.	0	0	0	0	33.3	66.7	5.67	.58
4. The material stimulated new thinking and inquiry.	0	14.3	0	0	42.9	42.9	5.00	1.41
5. The examples and explanations were at the appropriate level.	0	0	0	0	42.9	57.1	5.57	.53
6. The material was engaging (i.e. the students got more interested in the science content).	0	14.3	0	0	28.6	57.1	5.14	1.46
7. The students could understand the scientific information clearly.	0	0	0	0	50.0	50.0	5.50	.55

Table 57. Lesson 6 Graphic Content of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Illustrations, charts, maps, or graphs were clear and meaningful.	0	0	0	0	57.1	42.9	5.43	.53
2. Graphic content helped students understand the material covered.	0	0	0	0	57.1	42.9	5.43	.53
3. Illustrations promoted student thinking, discussion, problem solving, and inquiry.	0	14.3	0	0	28.6	57.1	5.14	1.46
4. Illustrations motivated students to read the text.	0	42.9	0	0	14.3	42.9	4.14	2.03
5. The material was engaging (i.e. it got them to do interesting things)	0	28.6	0	0	28.6	42.9	4.57	1.81

Table 58. Lesson 6 Format of the Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Lessons contained an appropriate amount of material.	0	0	0	0	42.9	57.1	5.57	.53
2. The size and format of print was appropriate.	0	0	0	0	42.9	57.1	5.57	.53

Table 59. Lesson 6 Organization of Text-based Materials Questions Results for Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The organization of the lessons (chronological, thematic) facilitated the development of specific concepts or skills identified in the lesson objectives.	0	0	0	0	42.9	57.1	5.57	.53
2. Main concepts were presented logically.	0	0	0	0	42.9	57.1	5.57	.53
3. The information was presented at an age-appropriate pace.	0	14.3	0	0	28.6	57.1	5.14	1.46

Table 60. Lesson 6 Instructional Design of Text-based Materials Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. The amount of prerequisite knowledge required to understand the material was acceptable.	0	0	0	0	57.1	42.9	5.43	.53
2. The learning objectives were stated clearly.	0	0	0	0	42.9	57.1	5.57	.53
3. The instruction followed an inquiry-based approach.	0	0	0	0	42.9	57.1	5.57	.53

Table 61. Lesson 6 Relevance of Text-based Materials Questions Results from Teachers.

Question	Percent Strongly	Percent	Percent Disagree	Percent Agree	Percent	Percent Strongly	Mean	Std.
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	Disagree	Disagree	a Little	a Little	Agree	Agree		Dev.
1. Materials and concepts were related to real life examples.	0	0	0	0	42.9	57.1	5.57	.53
2. Module materials and concepts fit nicely with my existing instructional materials.	0	0	0	0	33.3	66.7	5.67	.52

Table 62. Lesson 6 Effectiveness in Achieving Learning Outcomes Questions Results from Teachers.

Question	Percent Strongly Disagree	Percent Disagree	Percent Disagree a Little	Percent Agree a Little	Percent Agree	Percent Strongly Agree	Mean	Std. Dev.
1. Students should understand the effects of different nervous system injuries.	0	0	0	0	50.0	50.0	5.50	.71
2. Students should recognize that regions of the brain and spinal cord are associated with different, specialized functions.	0	0	0	0	0	100	6.00	.00
3. Students should be able to describe how the effects of spinal cord injuries differ from the effects of brain injuries.	0	0	0	50.0	0	50.0	5.00	1.41
4. Students should be able to explain why it is important to protect the nervous system from injury.	0	0	0	0	50.0	50.0	5.50	.71

Lesson 6 Difficulty. The scale used for the difficulty of each lesson was line across the page with three easily identifiable equidistant points for the students to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. As judged by teachers, the lesson 6 difficulty mean = 4.50 std. dev. = .71.

Lesson Comparisons. The lessons each have scores from the teachers on several dimensions. Table 63 depicts the average scores for each lesson when compared to the other lessons.

Table 63. Comparison of Lessons by Evaluation Dimension: Teacher Results

Evaluation Dimension	Lesson 1 Brain Games Mean & Std. dev.	Lesson 2 Making Sense of Our Senses Mean & Std. dev.	Lesson 3 Clear Signals Mean & Std. dev.	Lesson 4 Reflex or Response? Mean & Std. dev.	Lesson 5 Outside Influence Mean & Std. dev.	Lesson 6 Replacing Parts Mean & Std. dev.
Text-based Content	5.43 .35	4.93 .30	5.64 .30	5.18 .74	5.07 1.31	5.38 1.07
Graphic Content	5.44 .43	5.38 .53	4.88 .88	5.43 .55	5.89 .13	5.04 1.00
Format	5.56 .50	5.50 .71	5.63 .52	5.13 1.09	5.43 .93	5.57 .45
Organization	5.75 .46	5.50 .78	5.63 .74	4.92 1.59	5.71 .49	5.43 .79
Instructional Design	5.67 .36	5.75 .38	5.46 .53	5.42 .68	5.70 .38	5.52 .50
Relevance	5.71 .49	5.50 .91	5.14 .90	5.64 .63	5.75 .42	5.67 .41
Achieving Learning Outcomes	5.38 .88	5.73 .43	5.65 .42	5.60 .49	5.50 .79	5.50 .71
Website	5.71 .44	N/A	N/A	5.28 1.31	N/A	N/A
Level of Difficulty (Scale = 1 - 9)	3.00 1.00	4.00 .00	3.67 .58	7.67 1.53	5.00 .00	4.50 .71

In discussions of the utility of replacement or supplementary modules, the notion of difficulty of the modules and individual lessons comes up frequently. Table 64 is a comparison of the levels of difficulty for each lesson as well as the overall module. The scale used for all these estimations by the students and teachers was line across the page with three easily identifiable equidistant points to mark a judgment. At the left extreme was 1 = Extremely Easy, in the middle 5 = Just Right, and at the right extreme 9 = Extremely Hard. The averages are all in the middle range, close to "Just Right", therefore we must conclude that for this module the developers hit their target. The estimated difficulty was slightly higher in student estimations compared to teacher estimates in most cases.

Table 64: Comparison of Means of Teachers and Students Levels of Difficulty (Scale = 1 -9)

	Teachers	Students
Lesson 1: Brain Games	3.00	3.55
Lesson 2: Making Sense of Our Senses	4.00	3.60
Lesson 3: Clear Signals	3.67	2.77
Lesson 4: Reflex or Response?	7.67	4.55
Lesson 5: Outside Influence	5.00	3.39
Lesson 6: Replacing Parts	4.50	3.70
Overall Module	4.63	4.77

Module Difficulty. The teachers were also asked about the overall difficulty of the entire module. They rated the difficulty on a scale of 1 to 9 in which 1=too easy, 5=just right, and 9=too hard. The average level of difficulty was 4.63, std. dev. = 1.06.

Most and Least Valuable Aspects of the Module and Suggestions for Improvements. The teachers were asked to respond to an open-ended question on the most valuable aspects of the module and to discuss why. These comments are included in their totality in Appendix J.

Snapshots of Lessons. It is useful for the developers who work on specific lessons to have a picture of the impressions of the teachers and students who used their materials. Tables 65-70 contain information extracted from other tables and put here to provide a "snapshot" of each lesson. In addition, the rankings of these ratings are provided to give an idea of how they compare to other lessons. The rankings are meant to be useful only for gross comparisons. Sometimes the differences between ranks is great, sometimes the difference is quite small. Typical comments by teachers and students are included as well as an "Assessment". The assessment statements are meant to provide a starting point for the developers as they go into the next phase of the development process.

Table 65. A Formative Evaluation Snapshot of Lesson 1: Brain Games

	Teacher Rating	Teacher Rank (out of 6 lessons)	Student Rating	Student Rank (out of 6 lessons)
Difficulty	3.00 (Scale = 1 - 9)	6	3.55 (1 - 9)	4
Achieving Learning Outcomes	5.38 (Scale = 1 - 6)	6	N/A	N/A
Text-based Content	5.43 (Scale = 1 - 6)	2	4.72 (Scale = 1 - 6)	5
Graphic Content	5.44 (Scale = 1 - 6)	2	4.33 (Scale = 1 - 6)	5
Format	5.56 (Scale = 1 - 6)	3	N/A	N/A
Organization	5.75 (Scale = 1 - 6)	1	N/A	N/A
Instructional Design	5.67 (Scale = 1 - 6)	3	N/A	N/A
Relevance	5.71 (Scale = 1 - 6)	2	N/A	N/A
Website	5.71 (Scale = 1 - 6)	1 (2 lessons had web activities)	4.33 (Scale = 1 - 6)	2 (2 lessons had web activities)
		Teachers		Students
Typical Lesson 1 Comments		Good discussion They loved it Website good Back button problem High level of success with all levels of students		Too easy Liked games Easy to read Fun activity Liked stations
Assessment	The web activity was well-liked by students and teachers. Lesson 1 was perceived as the least difficult lesson and rated comparatively low by teachers in achieving learning outcomes. The text, graphics, relevance, and organizations all received high scores. Room for improvement includes adding more content or challenging material. Also, consider keeping the first lesson or 2 relatively easy so as to engage students, regardless of comments.			

Table 66. A Formative Evaluation Snapshot of Lesson 2: Making Sense of Our Senses

	Teacher Rating	Teacher Rank (out of 6 lessons)	Student Rating	Student Rank (out of 6 lessons)
Difficulty	4.00 (Scale = 1 - 9)	4	3.60 (1 - 9)	3
Achieving Learning Outcomes	5.73 (Scale = 1 - 6)	1	N/A	N/A
Text-based Content	4.93 (Scale = 1 - 6)	6	4.81 (Scale = 1 - 6)	3
Graphic Content	5.38 (Scale = 1 - 6)	4	4.17 (Scale = 1 - 6)	6
Format	5.50 (Scale = 1 - 6)	4	N/A	N/A
Organization	5.50 (Scale = 1 - 6)	4	N/A	N/A
Instructional Design	5.75 (Scale = 1 - 6)	1	N/A	N/A
Relevance	5.50 (Scale = 1 - 6)	5	N/A	N/A
Website	N/A	N/A	N/A	N/A
		Teachers		Students
Typical Lesson 2 Comments		Need a glossary. Students were not sure if they were scientists or detectives. Kids felt it was childish. Low level of interest. Did not dazzle students. The activities are fun and promote high level of interest.		It made me think. It was interesting. It was cheesy. It was fun but too broad. It was hard to understand because there were no pictures. Too easy.
Assessment	Lesson 2 rated 4 and 3 out of 6 in level of difficulty. It was rated high in instructional design by teachers but in the lower range on text and graphic content, format, organization, and relevance. It was perceived as interesting but a bit cheesy or childish by students. Students thought it both too hard and too easy...a good indication you hit the mark on difficulty! Consider modifications which jazz up the material a little as well as having more terms in a glossary.			

Table 67. A Formative Evaluation Snapshot of Lesson 3: Clear Signals

	Teacher Rating	Teacher Rank (out of 6 lessons)	Student Rating	Student Rank (out of 6 lessons)
Difficulty	4.00 (Scale = 1 - 9)	4	2.77 (1 - 9)	6
Achieving Learning Outcomes	5.65 (Scale = 1 - 6)	2	N/A	N/A
Text-based Content	5.64 (Scale = 1 - 6)	1	4.74 (Scale = 1 - 6)	4
Graphic Content	4.88 (Scale = 1 - 6)	6	4.42 (Scale = 1 - 6)	4
Format	5.63 (Scale = 1 - 6)	1	N/A	N/A
Organization	5.63 (Scale = 1 - 6)	3	N/A	N/A
Instructional Design	5.46 (Scale = 1 - 6)	5	N/A	N/A
Relevance	5.14 (Scale = 1 - 6)	6	N/A	N/A
Website	N/A	N/A	N/A	N/A
		Teachers	Students	
Typical Lesson 3 Comments		"Being" a neuron is effective. Mainly reinforced what students already knew. It was too childish. The transition talk on neurons was rather awkward. The culminating activity was great. Master 3.4 was easy to use. Master 3.5 was excellent discussion tool.	Too easy. It was fun, easy, & interesting. No website again. Good pictures. It was exciting that they all made sense. Clearly written.	
Assessment	Lesson 3 rated 4th and 6th in difficulty compared to the other lessons. Teachers rated it highest in text content and format but low in relevance, graphics, and instructional design. It was rated 2nd in achieving learning outcomes. It was perceived as fun and interesting but the terms childish and easy appear in the comments too often. Reinforcing existing knowledge is very useful, however, and its importance should not be overlooked. Consider adding something to enhance difficulty such as content or a challenging game.			

Table 68. A Formative Evaluation Snapshot of Lesson 4: Reflex or Response?

	Teacher Rating	Teacher Rank (out of 6 lessons)	Student Rating	Student Rank (out of 6 lessons)
Difficulty	7.67 (Scale = 1 - 9)	1	4.55 (1 - 9)	1
Achieving Learning Outcomes	5.60 (Scale = 1 - 6)	3	N/A	N/A
Text-based Content	5.18 (Scale = 1 - 6)	4	4.65 (Scale = 1 - 6)	6
Graphic Content	5.43 (Scale = 1 - 6)	3	4.54 (Scale = 1 - 6)	2
Format	5.13 (Scale = 1 - 6)	6	N/A	N/A
Organization	4.92 (Scale = 1 - 6)	6	N/A	N/A
Instructional Design	5.42 (Scale = 1 - 6)	6	N/A	N/A
Relevance	5.64 (Scale = 1 - 6)	4	N/A	N/A
Website	5.28 (Scale = 1 - 6)	2 (only 2 lessons had web activities)	5.03 (Scale = 1 - 6)	1 (only 2 lessons had web activities)
		Teachers		Students
Typical Lesson 4 Comments		Kids felt this was harder but liked the challenge! Students were intimidated by the vocabulary. All students were interested and engaged. Material needs more introductory information.		Too many big words. Web work better than reading on paper. Website was awesome. Examples and explanations were hard to understand. It was fun...I had to think. Make more circuits or examples.
Assessment	Lesson 4 was interesting and engaging. However, even with a web activity, which students and teachers liked a great deal, Lesson 4 was perceived as the most difficult and at the same time rather childish. Low scores on format, organization, and instructional design by the teachers suggest room for improvement. The vocabulary was intimidating to students. Room for improvement would include modifying the vocabulary, clarifying the examples and explanations, and adding more introductory information.			

Table 69. A Formative Evaluation Snapshot of Lesson 5: Outside Influence

	Teacher Rating	Teacher Rank (out of 6 lessons)	Student Rating	Student Rank (out of 6 lessons)
Difficulty	5.00 (Scale = 1 - 9)	2	3.39 (1 - 9)	5
Achieving Learning Outcomes	5.50 (Scale = 1 - 6)	5	N/A	N/A
Text-based Content	5.07 (Scale = 1 - 6)	5	4.83 (Scale = 1 - 6)	1
Graphic Content	5.89 (Scale = 1 - 6)	1	4.62 (Scale = 1 - 6)	1
Format	5.43 (Scale = 1 - 6)	5	N/A	N/A
Organization	5.71 (Scale = 1 - 6)	2	N/A	N/A
Instructional Design	5.70 (Scale = 1 - 6)	2	N/A	N/A
Relevance	5.75 (Scale = 1 - 6)	1	N/A	N/A
Website	N/A	N/A	N/A	N/A
		Teachers	Students	
Typical Lesson 5 Comments		Need information on parts of a neuron. Would be nice to have a web link or activity. Excellent overhead for 5.6. Hypothesis and data relationship was weak.	The branch chart was confusing. Liked the rat examples. It was easy to read. Nice lesson. Very easy and very motivating. Some questions were redundant.	
Assessment	Lesson 5 was 2nd in difficulty by teachers but 5th by students. It was a well-liked lesson that was perceived as interesting and fun. Again, teachers and students seem to want a web activity with every lesson. The excellent web activities on 2 lessons seem to have created the desire for more. Lesson 5 had high scores on graphic content, organization, and instructional design from the teachers. Room for improvement includes rethinking the hypothesis and data section, finding a web link for additional information if not an activity, and providing more information on the parts of a neuron.			

Table 70. A Formative Evaluation Snapshot of Lesson 6: Replacing Parts and Restoring Function

	Teacher Rating	Teacher Rank (out of 6 lessons)	Student Rating	Student Rank (out of 6 lessons)
Difficulty	4.50 (Scale = 1 - 9)	3	3.70 (1 - 9)	5
Achieving Learning Outcomes	5.50 (Scale = 1 - 6)	5	N/A	N/A
Text-based Content	5.38 (Scale = 1 - 6)	3	4.82 (Scale = 1 - 6)	2
Graphic Content	5.04 (Scale = 1 - 6)	5	4.43 (Scale = 1 - 6)	1
Format	5.57 (Scale = 1 - 6)	2	N/A	N/A
Organization	5.43 (Scale = 1 - 6)	5	N/A	N/A
Instructional Design	5.52 (Scale = 1 - 6)	4	N/A	N/A
Relevance	5.67 (Scale = 1 - 6)	3	N/A	N/A
Website	N/A	N/A	N/A	N/A
		Teachers		Students
Typical Lesson 6 Comments		Need a website. Needs stronger tie-back into regions of brain. Seeing PET scans would have been cool. Much of the information was too simple...the students wanted more.		Need more detailed and bigger graphics. Don't like essays. No website. Very interesting. Liked doing chart. It got everyone to talk about it.
Assessment	Lesson 6 was ranked 3 and a 5 on difficulty compared to other lessons. Teachers ranked it 5th in achieving learning outcomes and in the middle range on most other factors. A number of students did not care for the essays. The teachers and students would like web links or activities to see more examples. Consider adding more information and searching for web links to give the teachers and students more resources to explore on their own. The graphics were mentioned a number of times and should be examined for areas of improvement.			

Additional Analyses

Teacher Background Materials Evaluation. The teachers were asked to respond to a second set of questions about the background materials in a follow up survey after they had returned their evaluation materials. The survey was constructed with Perseus Software and sent to them at their email addresses. This software allows them to merely click on a URL in the email message which brings up the survey on their system. They then click on their responses or type in answers to open-ended questions, then click on a "Submit Survey" button. They respondents are then automatically returned to their email software program. The survey responses come back to us automatically and are installed in an Access database which we can analyze with SPSS. The responses are anonymous unless you ask the respondent to identify themselves which of course we had to do to match the responses with the rest of their data in our database. We did this for two reasons: (1) an oversight by the project evaluator in neglecting to put those questions on the mailed out questionnaire, and (2) to serve as a test for future applications of this technology for other BSCS projects. A copy of the Perseus web-based survey is included in Appendix H. Table 71 contains the results of the first three questions. Tables 72-75 contain the results of the open-ended questions. All the tables must be viewed with caution because there are fewer responses than to the general TEMS questionnaire.

Table 71. Teacher Background Materials Evaluation.

Question	Strongly Disagree	Disagree	Disagree a Little	Agree a Little	Agree	Strongly Agree	Mean	Std. Dev.
1. Overall, the Teacher Background Materials for this teaching unit were very useful.	0	0	0	0	14.3%	85.7%	5.85 (n=7)	.38
2. I found the references quite useful.	0	0	28.6%	0	14.3%	57.1%	5.00 (n=7)	.141
3. I would prefer to have the references inserted in the text of the Teacher Background section.	42.9%	28.6%	0	14.3%	14.3	0	2.29 (n=7)	1.60

Table 72. The three most important features of the Teacher Background materials for me were:

RESPONSES

They were clear and concise.
It is great to have the resources that go beyond what the students will be learning so that as a facilitator, we can add more info and have a strong understanding when especially since it seems to stimulate good discussions.
Content accompanied by diagrams
Content correlated to standards and conceptual flow of the lessons
Preparation notes accompanied by premade worksheets.
The specific info about the brain. It is more specific than most other sources I have seen.
The info about the different types of neurons.
Plasticity and learning section.
Easy reference to material in front of book.
Information provided was very useful.
I could easily refer when needed.
I feel the background materials were very well organized. The were extremely useful to me because the topics and subtopics were clearly noted and I found them easy to utilize. I prefer to have all the background info in one place rather than scattered throughout the text. Although I might not have actually read all the materials at once, I found them very helpful and I used them as I needed them.
I think the depth of knowledge covered in the background materials was appropriate for middle school level. I did not feel that the materials contained a lot of unnecessary info, not was there any info that was too advanced.
The illustrations inserted throughout the materials were also useful to me - I found them helpful and easy to understand.
Easy to understand.
Great detail.
Good pictures to go with text.

Table 73. I would like to have seen the following additional information in the Teacher Background materials.

RESPONSES
Overview of current research projects about the spinal cord and brain
Premade, color overheads of diagrams that go with lessons.
Somewhere, there needs to be more specific answers to some of the student questions that arise. For example, in the sections where they see the branches of the neurons, what those branches are needs to be addressed. My kids asked about that.

Table 74. The Teacher Background materials could have omitted:

RESPONSES
I felt all the materials were useful.
Perhaps you could have omitted some of the basic, general information, but that may not be true in the experience of some teachers.
How can safety be promoted in the classroom. Teachers should know this already.

Table 75. How could the Teacher Background materials be made more useful?

RESPONSES
Whatever the format you use please make sure it's easy to move around for the teacher. It was discussed that some teachers wanted the info in one place, others stated that they would personally place the background in other points of the materials as they saw fit. So an example of this is not to double side the materials of different lessons background.
Have the background in the sections they are used.
I found the materials very teacher friendly.
Perhaps, if they were tailored more to the specific units so they could address specific questions, they would be more useful. However, I thought they were very good as they are!
The info was useful. I see no changes needed.
I found the materials to be very useful just as they are written.
Although it did refer what lessons the materials related to - I guess I would have liked it if it were more "separated". i.e. I would have put all the info about PET scans and MRIs with the info about brain injury and protection. The MRI info was not with the brain injury section and naturally this is when I wanted it (as kids will naturally want to know about MRIs and CAT scans when you are teaching about PET scans...) If all of this stuff had been in a "section 6 background" section it would have been more useful.

D. Results of Summative Evaluation

The summative evaluation consists primarily of examination of the differences between the student's Pretest and Posttest scores on a "Student Knowledge Survey". The items were statements which the students could indicate True, False, or Not Sure. Appendices E and F contain copies of these surveys. The students took the first Knowledge survey (the Pretest) before exposure to the materials and the Posttest after using the materials. All students answered questions 1 – 15. Additionally, analysis of the "Not Sure" responses was conducted as well as the teacher's estimates of the success in achieving learning outcomes.

T-Tests. The students' answers were scored with answer keys which yielded the number of items they got correct. The Not Sure responses were scored as incorrect in the initial analyses. The mean number of correct responses on the Pretest = 15.74(out of 29, Std. Dev. = 4.85). The mean

number of correct responses on the Posttest = 18.85 (out of 29, Std. Dev. = 4.37). The t-test for Pretest and Posttest scores (using questions 1-15) was -13.833, $df=426$, $p < .01$ (two-tailed).

One-way Analysis of Variance. A one-way analysis of variance was also conducted because t-tests are primarily comparisons of significant differences between means. The one-way analysis of variance gives us an idea of whether the variances in the scores also are significantly different. The obtained F value = 6.065, $p < .01$. This means that the variances were significantly different. Based on the t-tests and the one-way ANOVA we have substantial evidence that the materials increased student learning of the items covered in the Knowledge Test

Correlation. It is also useful in conceptualizing the relationship between pretest and posttest scores to view them as correlates. Essentially, this view is that the higher a score on the pretest, the higher the score on the posttest, or what is termed a "positive correlation". Since the variables are interval level measures a Pearson's r correlation coefficient was calculated. The Pearson's r for the pretest and posttest scores = .494, $p < .01$. This is a statistically significant correlation. Essentially, this means that when you take the square of the .494 figure to obtain r^2 you get the amount of variance in the posttest scores which is explained by the pretest scores. This $r^2 = .24$ or 24 percent of the variance in the posttest scores is explained by the preexisting level of knowledge which was measured by the pretest scores. It can be assumed that the remaining variance in the posttest scores (that is, most of it) is explained by other factors, such as exposure to the instructional materials and teaching the students have received.

Analysis of "Not Sure" Responses. In addition to the analysis of the True-False answers on the Pretest and Posttest Knowledge Surveys, there is a "Not Sure" category of response. This response was offered on the survey because it essentially is a non-threatening option for students to choose when they in fact don't know what is the answer. This is entirely possible for many students because they had not yet covered the material. Correct answers are probably the result of their own reading, good guessing, or luck. We wanted to establish that it was OK to say they did not know the material rather than to guess. Therefore, scores were computed for the number of "Not Sure" responses for each student on the Pretest and the Post Test. The mean number of Not Sure responses for the Pretest = 7.35 (out of 29, Std. Dev. = 6.16). The mean number of Not Sure responses for the Posttest = 3.21 (out of 29, Std. Dev. = 4.03). The t-test for these means = 15.93, $df = 426$, $p < .01$, two-tailed). This means that the average number of Not Sure responses was substantially lower in the Posttest than in the Pretest. Guessing or uncertainty seems to have been diminished.

Teacher Estimation of Achieving Learning Outcomes. The pretest and posttest scores are the primary method of determining the results of the summative evaluation. Another input for this evaluation is the judgments of the teachers on how effective the lessons and the overall module were in achieving the learning outcomes. Tables 19-62 give the distribution of responses from the teachers. Table 76 below summarizes the results of those tables. The scale is 1= Strongly Disagree, 2=Disagree, 3=Disagree a Little, 4=Agree a Little, 5=Agree, 6=Strongly Agree.

The questions the teachers were answering were whether they agreed or disagreed that the lessons were effective in achieving the specific lesson learning outcomes. The table clearly shows that the teacher judgments fell predominantly in the Agree and Strongly Agree range on these statements. The lowest score was in Lesson 5: Outcome 1 and Lesson 4: Outcome 2. These scores, however, were still in the Agree range. The highest scores also were on Lesson 5: Outcome 2 and Lesson 6: Outcome 2.

Table 76. Teachers Summative Judgments on Achieving Learning Outcomes.

Learning Outcomes	Mean & (Std. dev.) (Scale = 1-6)
Lesson 1 Learning Outcomes	
1. Students should recognize that the brain is capable of performing many diverse functions.	5.25 (.139)
2. Students should be able to explain how various brain functions contribute to human learning.	5.50 (.53)
Lesson 2 Learning Outcomes	
1. Students should appreciate that the body gathers multiple types of sensory information.	5.67 (.58)
2. Students should recognize that the brain is responsible for correctly combining multiple types of sensory information.	5.67 (.58)
3. Students should understand that combining multiple types of sensory information improves our ability to understand our environment.	5.67 (.58)
Lesson 3 Learning Outcomes	
1. Students should be able to explain that the brain generates responses that the body carries out.	5.33 (.58)
2. Students should be able to articulate that the brain must correctly process information before producing a response.	5.33 (.58)
3. Students should be able to describe the significance of the brain to information flow.	5.33 (1.15)
4. Students should understand that information flows through specialized cells called neurons.	5.00 (1.00)
Lesson 4 Learning Outcomes	
1. Students should understand that neurons in the body are connected into circuits.	5.50 (1.41)
2. Students should be able to describe the path of information flow through a neural circuit.	4.50 (2.07)
3. Students should be able to construct correct circuits for both voluntary and involuntary actions.	5.50 (1.41)
4. Students should recognize that reflex circuits involve the spinal cord and not the brain, while all voluntary circuits require neural connections to the brain.	5.63 (1.06)
5. Students should be able to explain why we have more control over our voluntary circuits than our involuntary circuits.	5.86 (.35)
Lesson 5 Learning Outcomes	
1. Students should be able to explain the relationship between a hypothesis and experimental data.	4.00 (2.65)
2. Students should be able to describe how the environment can affect both the structure and function of the brain.	6.00 (.00)
3. Students should understand that the brain changes throughout life.	5.67 (.58)
Lesson 6 Learning Outcomes	
1. Students should understand the effects of different nervous system injuries.	5.50 (.71)
2. Students should recognize that regions of the brain and spinal cord are associated with different, specialized functions.	6.00 (.00)
3. Students should be able to describe how the effects of spinal cord injuries differ from the effects of brain injuries.	5.00 (1.41)
4. Students should be able to explain why it is important to protect the nervous system from injury.	5.50 (.71)

Additional Analyses.

School Comparisons. In analyzing the data it is also useful to break down differences between sampled units. Schools were selected to be in the field test because they differed in terms of geographic region and racial and ethnic composition of the student body. The primary sites received a field test orientation and the secondary sites did not. The t-tests reported are paired comparisons. The difference (or gain) scores are calculated by subtracting the pretest mean from the posttest mean. Table 77 contains the result of these analyses.

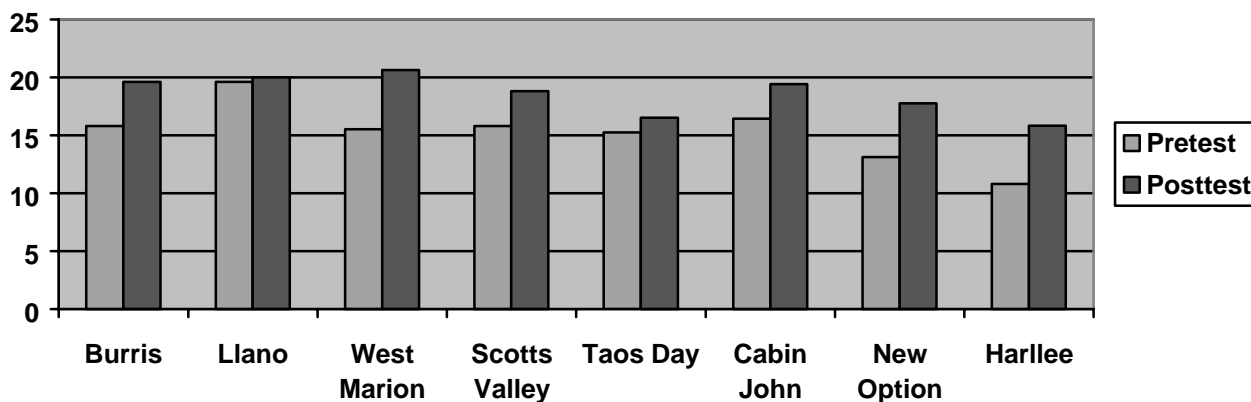
Table 77. School Comparisons on Pretest and Posttest results.

School	Primary or Secondary Site	n	SKS1 (Pretest) (Range =0-29)	SKS2 (Posttest) (Range =0-29)	t-test	Difference (Gain) Score
1. Burris Laboratory School	Primary	36	Mean = 15.81	Mean = 19.61	t = 5.87 p<.01	3.80
2. Llano Jr. HS	Primary	94	Mean = 19.61	Mean = 20.01	t = 1.01 p>.01 (NS)	.40
3. West Marion Jr. HS	Primary	46	Mean = 15.52	Mean = 20.63	t = 8.25 p<.01	5.11
4. Scotts Valley MS	Primary	44	Mean = 15.80	Mean = 18.82	t = 5.33 p<.01	3.02
5. Taos Day School	Primary	17	Mean = 15.24	Mean = 16.53	t = 1.58 p>.01 (NS)	1.29
6. Cabin John MS	Primary	83	Mean = 16.43	Mean = 19.42	t = 6.14 p<.01	2.99
7. New Option MS	Primary	52	Mean = 13.12	Mean = 17.75	t = 7.09 p<.01	4.63
8. Harlee MS	Primary	55	Mean = 10.80	Mean = 15.84	t = 6.63 p<.01	5.04

The t-tests were significant for Burris, West Marion, Scotts Valley, Cabin John, New Option, and Harlee. The t-tests were not significant for Llano Jr. HS and Taos Day School. The average difference score for the schools was 3.29. West Marion Jr. HS had the highest difference score of 5.11 and Llano Jr. HS had the lowest difference score of .40.

Another way of visualizing the results of comparing the schools is depicted in Table 78. This table shows the results of the pretest for each primary school along with its posttest results.

Table 78. Another Comparison of Pretest and Posttest Scores



Section V. Discussion of Results

A. Field Test Demographics.

There inevitably is a conflict between the need for representative samples and the demands of the real world to identify and access willing teachers and students. In field tests, it is logical to identify teachers who are willing, capable, and have the laboratory resources to conduct the tests even though their classes might not yield representative samples. The goal of the evaluation is to test and evaluate new curriculum materials. What better set of subjects to test than those who can use it and articulate its advantages and disadvantages?

The primary field test sites were quite diverse. They varied in urban-suburban-rural, racial/ethnic composition, and geographic region of the U.S. The secondary sites were "opportunistic" in nature, that is, they were included because they applied not because they helped establish "inclusiveness" in any way. We intended to include them in the analyses and compare them to the primary groups to examine possible differences. The instructional module materials and evaluation forms were mailed to these schools but no evaluation materials were returned.

B. Formative Evaluation Results from Students.

Utility of Student Results for Developers. In general the results in Tables 3 to 18 are most useful to the developers to obtain the impressions of the students on the different areas of evaluation. The percentage results on all lessons are more dispersed and have more disagreement than the teachers' answers for similar questions. It is suggested that the developers review the separate tables for each lesson and focus on those with the most dispersed and lowest average scores to find room for improvement. For example, in Lesson 4 was perceived as the most difficult

lesson by teachers and students. Lesson 3 was the least difficult according to teachers but Lesson 3 was least difficult to students. Surprisingly, the overall module difficulty rating by students (4.77) was higher than any of the individual lesson difficulty ratings. Reading the comments by the students on these lessons should reveal why they thought this way and give clues to remedies for the materials. Each lesson has a table on the text-based question responses, the graphic content questions, and the lesson difficulty. In addition, lessons 1 and 4 have questions pertaining to the website activities. Comparing the same average of responses to questions across the lessons will give you an idea of how well the different lessons were evaluated by the students. Table 16 contains the result of calculating composite scores for each category of questions for each lesson.

Comments from Students. Appendix I contains the comments from the students on Lessons 1-6, the Most and Least Valuable Aspects of the Module, and Suggestions for Improvements. Because there are responses for 440 students this is a large appendix with many comments. The Most Valuable Aspects of the Module included items such as the Brain Games, spinal cord injuries, PET Scans, and web activities. The Least Valuable Aspects of the Module included items such as the rat swim, detective games, and Lesson 4 because it was too hard. Suggestions for improvements included items such as more web activities and videos, improving lesson 4, and eliminating essay questions. These items are only a sample of the many comments made by students. The developers should review the comments in each section to see the diversity and number of comments and to identify possible areas for change.

Comparison of Student Results on Lessons. Table 18 contains the results of calculating the averages for the various sets of questions on different evaluation dimensions: Text-based Content, Graphic Content, the Website. The Text-based Content and Graphic Content results are very similar for all the lessons.

Lesson and Overall Module Difficulty for Students. The results on the level of difficulty judgments by students suggests that even though they are all close to the *just right* mark that lesson 4 was perceived as the most difficult and lesson 3 as the easiest by the students.

C. Formative Evaluation Results from Teachers.

Utility of Teacher Results for Developers. Even a brief perusal of the results depicted in Tables 19-62 clearly shows that the results from the teachers are less dispersed and focused more in the *agree* range. The average for virtually all the questions was higher than the results for similar questions asked of the students. Again, the task for the developers in examining these tables is to focus on the low scores and most dispersed sets of responses to statements. In so doing, they should identify likely candidates for modifications and improvements in the materials.

Comments from Teachers. Appendix J contains the comments from the teachers on Lessons 1-6, the Most and Least Valuable Aspects of the Module, and Suggestions for Improvements. The Most Valuable Aspects of the Module included items such as the hands-on nature of the module, the Brain Games, PET Scans, and incorporating inquiry. Least Valuable Aspects of the Module included items such as the "creature activity", some lessons being too childish, and needing more "meat" or content in some areas. Suggestions for improvements included items such as adding more content, more web activities, and cutting back on photocopying requirement. These items are only a sample of the comments made by teachers. The developers should review the comments in each section to identify candidate areas for changes.

Comparison of Teacher Ratings on Lessons. Table 63 contains the results of calculating the averages for the various sets of questions on the different evaluation dimensions. Most of the results are in the *agree* range on these items. However, the developer can identify strong and weak areas of lessons by comparing the lessons to each other, much as the teachers and students did. In this manner, the text-based content of lesson 2 was evaluated lowest, the organization of lesson 4 was evaluated lowest, and so forth. Interestingly, as opposed to the students, the teachers thought that lesson 4 was the most difficult and lesson 1 was the least difficult. It should be noted however, that most of the difficulty score averages from the teachers were near or below the "just right" score of 5. The exception was lesson 4 which was considered difficult (mean = 7.67).

Lesson and Overall Module Difficulty. Table 64 is a comparison of the results of the lessons' and overall module difficulty scores of the teachers and students. Teachers evaluated most of the lessons as more difficult than did the students but were very close to the students on their estimates of the overall module difficulty.

Teacher Background Materials. The questions asking for evaluation information on the Teacher Background Materials yielded positive results. The results in Table 71 suggest that the materials were useful and the references useful. However, most teachers, in responding to Question 3 on where references should be placed, did not want them in the text of the Teacher Background section. Comments on the best features included worksheets, easy referencing, well organized, easy to understand, and easy to use. The teachers wanted premade color overheads, more specific answers to student questions, and more information on the spinal cord and brain.

D. Summative Evaluation Results.

Student Knowledge Surveys. The results from the student knowledge surveys clearly showed that the module had the intended instructional impact when the results for all schools are combined. Table 77, however, indicates that two schools, Llano Jr. HS and Taos Day School, did not have significant differences between pretest and posttest scores.

Llano Jr. HS, with a pretest average of 19.61, had the highest pretest score average of all the field test sites but did not have a significant increase in the posttest scores. It is possible that the classes at that school had already covered the material in the Brain module and therefore scored higher on the pretest. Subsequently, perhaps there was little room for improvement. Taos Day School, on the other hand, had a pretest average of 15.24, in the normal range, but achieved a posttest average of only 16.53. The small size of the group (n=17) or other factors, such as being entirely American Indian, may have had an impact on the successful use of the Brain module materials.

To help understand the source of this difference, the average difficulty ratings for each lesson and the overall module were examined. Table 79 contains the results. T-tests were run between the group which had significant differences between the pretest and posttest scores, consisting of Burris, West Marion, Scotts Valley, Cabin John, New Option, and Harllee and another group which did not have significant differences between the scores, Llano and Taos. The results show that only on Lesson 2 were the difficulty ratings significantly higher in the second group (the group that had no significant differences between pretest and posttest scores). There appears to be no consistent pattern in the quantitative results which lead to understanding the basis for the differences. It is suggested that the developers review the comments and the site visit notes for insights into the source of the differences in these groups.

Table 79. Comparison of Groups of Schools on Levels of Difficulty

	Group¹	n	Mean	Standard Deviation	t-test
Lesson 1 Difficulty	1	327	3.505	2.060	t = .872 p>.01 (NS)
	2	113	3.699	1.995	
Lesson 2 Difficulty	1	327	3.330	2.218	t = 4.504 p<.01
	2	113	4.398	2.157	
Lesson 3 Difficulty	1	327	2.746	2.127	t = .329 p>.01 (NS)
	2	113	2.823	2.176	
Lesson 4 Difficulty	1	327	4.523	2.513	t = .405 p>.01 (NS)
	2	113	4.637	2.778	
Lesson 5 Difficulty	1	327	3.425	2.275	t = .494 p>.01 (NS)
	2	113	3.301	2.378	
Lesson 6 Difficulty	1	327	3.724	2.325	t = .345 p>.01 (NS)
	2	113	3.637	2.322	
Overall Module Difficulty	1	327	4.72	1.514	t = 1.141 p>.01 (NS)
	2	113	4.92	1.408	

1. Group 1 = Burris, West Marion, Scotts Valley, Cabin John, New Option, & Harlee
Group 2 = Llano & Taos

Teacher Judgment on Effectiveness in Achieving Learning Outcomes. We also obtained the additional input of summative data from the teachers on achieving the learning outcomes for the various lessons. These results, in Table 76, clearly support the student knowledge survey results. The module was a summative success in achieving the learning outcomes.

Section VI. Conclusions and Recommendations

A. Conclusions

The formative evaluation of the Brain Module Materials clearly shows that the module has been very well crafted and most of the modifications will be of a fine-tuning nature not an overhaul. The open-ended responses yielded a mixed set of comments about what the students and teachers liked and disliked. The responses should be examined by the developers and overlaid with the results of the site visits by staff to obtain most likely areas for improvement to the module.

The summative evaluation results suggest that the module was very effective in all lessons and yielded statistically significant changes in scores from pretest to posttest results as well as high judgments by teachers of the effectiveness in achieving learning outcomes. The developers should investigate the reasons for a lack of results in two of the field test sites.

B. Recommendations Regarding the Project

Primary versus Secondary Teachers and Sites. It would be useful in future applications to have secondary sites to compare results. If the project director were to pay the secondary site teachers a nominal fee (perhaps \$100.00) to return the evaluation materials it might substantially increase the return rate for these materials. This is useful because the comparison between these two types of sites gives us insight into whether the professional development offered in the field test orientation to the primary teachers really is necessary to effectively use the materials. Ideally, the field test orientation should increase effective use of the materials but the instructional materials should stand on their own when supported by the teacher background materials.

Time for Evaluation Data Entry and Analysis. The Brain module was used in February - March of 2002 with the evaluation materials returned to BSCS in March. After receipt of the questionnaires the data entry was begun. The evaluation reports for this module as well as the Using Technology and Energy Balance modules all have due dates of 1 May 2002. It is recommended that on future proposals more time be allocated to the evaluation data entry and analysis for review, contemplation of results, and report writing.

Pilot Test Formative Evaluation. It is recommended that a local pilot test be included in future proposals and that early formative data gathered be included in modifications to the module materials.

Access by Persons with Disabilities (PWDs). It is recommended that we create curriculum materials, in all their various forms, in ways that allows access by persons with disabilities (PWDs). One of the populations of American society which will benefit greatly from technological advances in computers, CD-ROMs, DVDs, websites and internet access in general are persons with disabilities. The Americans with Disabilities Act (ADA) was passed in 1993 and sets standards and mechanisms for access for PWDs. The Department of Education has a number of agencies working to improve access by PWDs such as the National Institute on Disability and Rehabilitation Research (NIDRR). Also, Congress passed the Workforce Investment Act in 1998 which mandates changes in software and peripheral devices to allow access by PWDs.

We should consider enabling access to our curriculum materials by PWDs and including the cost and time of doing so in our proposals. The modifications are somewhat different for different types of disabilities and often depend on unique technology which the PWD has at their location (such as software on their computer which enlarges text for visually impaired persons). The software for websites can be written in such a fashion as to enable the use of the different input and output devices used by PWDs. Usually, websites are not so constructed. The nonprofit Center for Applied Special Technology (CAST) has procedures to follow to do this and subsequently receive their "Bobby-Approved" status. This approval indicates to the disabled community that certain standards have been met and they will likely have no trouble accessing the site <www.cast.org>. These types of innovations in our curriculum materials, whether stand alone, such as a CD-ROM, or installed and accessible at our website, would make the materials available to a much wider audience.

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